Western Electric Co., Incorporated,
Engineering Dept.,
New York.

Appendix 1.
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METHOD OF OPERATION
TESTING CIRCUIT

Wiring of A 50-A Dial Tester - Local Test Desk - Full Mechanical Power Driven System.

1. Paragraph 3 add the following note:

NOTE: - There should always be sufficient time allowed after setting the disk in starting position to permit the disk to come to rest before the dial is operated.

2. Paragraph 9 Under the FIRST item omit the second sentence.

3. Under Mechanical Requirements add the following paragraph:-

3. With the disk in its starting position, the maximum clearance between the pendulum stop pin and its stop should be .015"

ENG.--JLS-BH.
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APPROVED - C.L.SLUYTER, G.M.L.

Western Electric Co., Incorporated,
Engineering Dept.,
New York.

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METHOD OF OPERATION
TESTING CIRCUIT

Wiring Of A 50-A Dial Tester - Local Test Desk - Full Mechanical Power Driven System.

GENERAL DESCRIPTION

1. This circuit is used at the local test desk in a full mechanical office for testing the speed of dials at subscribers' stations. It consists mainly of a mechanical unit mounted on the test desk and has a timing element consisting of a heavy disk supported on a steel wire, which is under tension between an upper and a lower support. The disk is set for a test by rotating the starting lever to a point 180 degrees to the left and then back to its normal position. The disk is held stationary in the start position by a pawl attached to a stop magnet. A stepping relay, operated by dial impulses rotates a commutator which controls the operation of the stop magnet.

2. In making a test the digit 0 is dialed. The stop magnet is operated after the first impulse, releasing the pawl which holds the disk at the starting point. The disk released, rotates towards the right due to the torque set up in the steel wire when the disk was rotated off normal. After the tenth impulse the stop magnet is released, stopping the movement of the disk. A scale graduated to read impulses per second is mounted on the disk and indicates by a pointer, the rate of speed of the dial.

DETAILED DESCRIPTION

3. Before making a dial test the subscriber's line is connected to the local test cord circuit and tested for grounds, crosses, etc. The starting lever of the tester is then moved from its normal position at the right of the tester to the start position at the left of the tester and then back to the normal position. This operation rotates the disk to its start position. When the lever is moved from its normal position, the transfer springs operate mechanically, closing a circuit through the stop magnet. The stop magnet operates, disengaging its locking pawl from the teeth on the rim of the disk, thus permitting the disk to be moved freely. If the commutator of the stepper is not in its normal position, that is resting on an insulated segment, the operation of the transfer springs also closes a circuit from ground through the commutator and brush, break contact of the stepper magnet, contact of the transfer key and winding of the stepper magnet to battery. The stepping relay then alternately operates and releases as the circuit is closed and broken at its break contact until the circuit through the commutator is broken by an insulated segment, after which the stepper magnet remains released. When the lever reaches the extreme left position, the transfer springs break contact, opening the circuit through the stop magnet. The stop magnet releases, allowing its pawl to drop into a slot on the rim of the disk, thus locking the disk in the start position.

4. The dial test key in the test cord circuit is next operated, connecting the tip and ring of the subscriber's line to leads A and B and also connecting leads T and R to a supervisory circuit in the test cord circuit to give switchhook supervision. With the receiver off the switchhook at the sub-station, a circuit is closed from ground through the outer winding of the 66-A repeating coil, tip of test cord, tip of line, sub-station set, ring of line and ring of test cord to battery through the inner winding of the L relay. The L relay operates, in turn operating the SLR relay which extinguishes the supervisory lamp in the test cord circuit. A dial tone is induced through the windings of the 66-A repeating coil as an indication that the dialing may be started. The zero digit is dialed and at the first opening of the dial contacts, the L relay releases. The SLR relay is constructed to be slow in releasing and does not release with the L relay on the dial impulses. The L relay released, closes a circuit from ground on its armature, through make contacts of the SLR relay, break contacts of the transfer springs and winding of the stepper magnet to battery, operating the stepper magnet. When the dial springs again close the circuit, the L relay re-operates and opens the circuit through the stepper magnet. The stepper releases and in so doing rotates its commutator one step, which closes a circuit from ground through the commutator and brush, contacts of the transfer springs and winding of the stop magnet to battery. The stop magnet operates, disengaging its pawl from the starting slot which allows the disk to start swinging towards the right.

5. At each succeeding impulse the L relay releases and re-operates, in turn operating and releasing the stepper magnet which advances the commutator one step with each impulse. The commutator segment and brush continue to make contact until ten impulses have been received, when the circuit through the stop magnet is opened by an insulated commutator segment. The stop magnet releases and its pawl engages the teeth on the rim of the disk, bringing it to a stop. If the dial meets the requirements, the pointer will indicate a speed between the minimum of eight pulses per second and a maximum of eleven pulses per second.

6. When the receiver is replaced on the switchhook at the station, the L relay and SLR relays release, lighting the supervisory lamp in the test cord circuit as a disconnect signal. Releasing the dial test key restores the circuit to normal.

7. The 400 ohm resistances and 1/2 M.F. condensers provide protection against sparking at the contacts of the stepper magnet and commutator.

CHECK TEST

8. Immediately after installation and periodically during its use, the adjustments of the instrument should be checked, paying special attention to the spring tensions and to the timing feature.

TIME CHECK

9. The timing feature should be checked in the following manner:-

FIRST. The dial tester should be mounted in a vertical position. This may be checked by using the surface of the top protecting tube as a reference.

SECOND. Move the starting lever to its extreme left hand position and then back to its normal position. The stop magnet pawl should fall in the starting slot and rest against the first tooth on the rim of the disk. With the disk held in this position, the start mark on the scale should be directly beneath the pointer. Any adjustment necessary can be made by loosening the screws at either end of the scale and sliding the scale to the right or left as the case may be until the start mark and the pointer coincide.

THIRD. Operate the dial test key and temporarily short circuit the tip and ring of the associated test plug. (This may best be accomplished by inserting the plug in a short circuited jack). Remove the short circuit, allowing the disk to oscillate freely until it comes to rest. The disk should stop with the figure 10 exactly beneath the pointer. If necessary, make correction as follows:

(1) Remove the top protecting tube.
(2) Release the knurled locking screw in the torsion head.
(3) Turn the torsion head in the proper direction to line up number 10 on the scale with the pointer.
(4) Tighten the locking screw and replace the tube.

FOURTH. Test the freedom of movement of the disk by re-setting it at the starting point and releasing it as before by short circuiting the test plug. Count the swings of the disk (a complete swing being a motion from one extreme position of the disk to the opposite extreme position). After twenty swings the decrease in amplitude should not exceed ten degrees, as indicated on the scale. This test insures proper alignment of the instrument, which in turn insures freedom of movement for the disk.

FIFTH. Check the time interval by setting and releasing the disk as before and counting the swings of the disk. Fifty complete swings should occur in from 90 $\pm$ 1 seconds, as measured by a stop watch.

NOTE: The speed of the disk may be varied by means of the adjusting screw on its rim, but it is very improbable that such adjustment should be needed, therefore this adjusting screw should be moved only after an accurate check of all other parts has failed to remedy the trouble, or in the case of repairs such as replacement of the steel support wire.

SPRING TENSION CHECK

10. In checking the tensions of the various springs, the individual requirements will be found under the heading Mechanical Requirements.

CAUTIONS.

11. After setting the disk at the starting point the lever should always be returned to the extreme right hand position before the dial is operated, to prevent interference with the motion of the disk.

12. The instrument is designed to test the speed of dials only when the digit 0 is dialed. If any other digit is dialed, the stop magnet is not released and the disk will continue to oscillate after the dial has come to rest.

13. Care should be taken not to jar the instrument during a test since the accuracy of the result will be affected.

14. For the correct operation of the dial tester it is essential that the tension springs of the stop magnet be within the limits specified in the Mechanical Requirements.

CIRCUIT REQUIREMENTS

MECHANICAL REQUIREMENTS
50-A DIAL TESTER

1. The suspension wire should always be kept taut by keeping the knurled screw which is attached to the lower head screwed down until the clearance between the adjacent turns of the spring is approximately 1/64 of an inch or an amount just sufficient to prevent adjacent turns from touching.

2. The clearance between the stop magnet pawl and the disk teeth with the stop magnet operated shall be .012" plus .005" or minus .002".

STOP MAGNET: (1). The armature springs shall each have a tension of 30 plus or minus 3 grams when measured at the end of the springs with the armature in its operated position.
(2). The armature air gap shall be .040" plus or minus .002".

STEPPING MAGNET. (1). The commutator brush shall have a tension of 30 plus or minus 3 grams when measured at the end of the brush.
(2). The armature springs shall each bear against the armature with a pressure of 85 plus or minus 5 grams, measured at the end of the springs with the armature in the operated position.
(3). The contact springs shall have a tension of 28 plus or minus 3 grams when measured at the end of springs.
(4). The driving pawl shall have a pressure of 30 plus or minus 5 grams against the root of any tooth.
(5). The retaining pawl shall have a pressure of 25 plus or minus 5 grams measured at the crown of any tooth.
(6). The armature air gap shall be .044" minimum and .047" maximum measured between the back of armature and the armature stop nut when the armature is in the operated position.
(7). Short circuit the two lower transfer springs and move the starting lever slightly from its normal position. The stepper magnet should then operate in a circuit through its winding and break contact at a speed which will rotate the commutator 10 complete revolutions in 16 seconds.

CIRCUIT REQUIREMENTS

ELECTRICAL REQUIREMENTS

	OPERATE	NON-OPERATE	RELEASE
178-AH (SLR)	Special requirements to insure slow release. Readj. .018 amp. Test .019 amp. W.C.C. .041 amp.		Readj. .001 amp. Test .0009 amp.
E827 (L) Inner Wdg. (500 ohms).	Special requirements to insure speed. Armature travel .020" ± .0025". Readj. .0145 amp. Test .015 amp. W.C.C. .025 amp.	Readj. .013 amp. Test .0125 amp. W.C.C. .0047 amp.	
Outer Wdg. (500 ohms).	Test .020 amp.		

ENG.--WAL:ML. CHK'D.--ASP:CWP. APPROVED - C. L. SLUYTER, G.M.L.
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